OPTIMIZED CACHE POLICIES AND RESOURCE ALLOCATION FOR FOG COMPUTING ENVIRONMENTS

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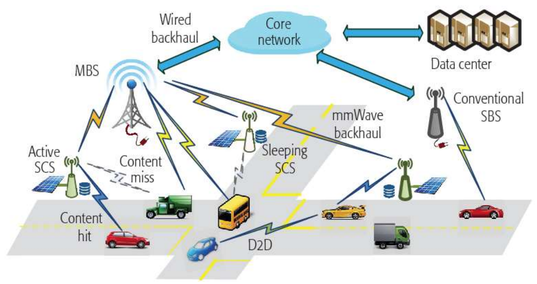
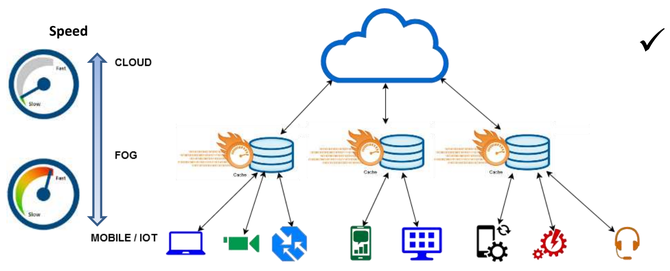
Motivation

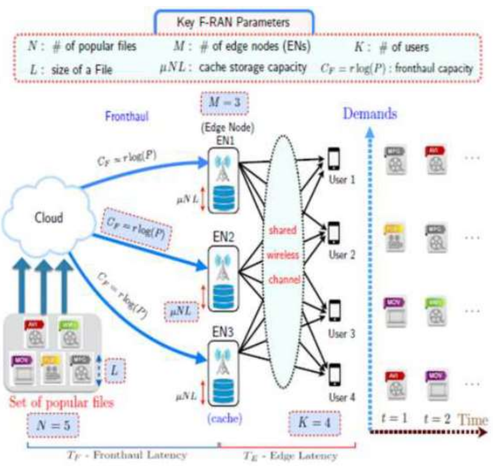
- ✓ Future 5G networks results in growing data traffic and a large consumption of network resources, power and computing.





- ✓ Fog computing, maximize the system performance by leveraging both Cloud and Fog (or Edge) resources [1].

- ✓ The design of caching schemes can help significantly to reduce latency largely and helping to offload data from the base stations opportunistically [2][3].



Thesis Objectives

- ✓ Establish the critical characteristics of coded caching in hierarchical network architectures on fog computing environments
- ✓ Develop a mathematical model for analyzing different caching and coded caching protocols and strategies for fog computing environments
- ✓ Develop a scheme for hierarchical network architectures to optimize the performance of latency and storage of contents on fog computing
- ✓ Present an analytical development about the effects of caching and transmission mechanisms on the interaction of mobile terminals

Research Plan

	Activities	2016	2017	2018	2019	2020
1	State of the Art on coded caching					
2	Propose the Evaluation Framework					
3	Implementation of schemes for Coded Caching in NS3 Simulator					
4	Development and validation of proposed mathematical model					
5	Simulation and evaluation of proposed optimized scheme					
6	Publication of results in Conferences and International Journals					
7	Preparation of the Ph.D. Disertation					

Next Year Planning

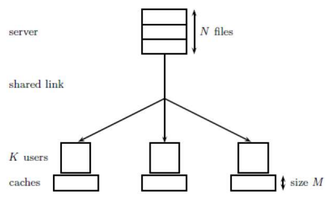
- Complete the Evaluation Framework
- Evaluation of Coded Caching schemes in F-RAN
- Development of mathematical model
- Publication of results in Journals

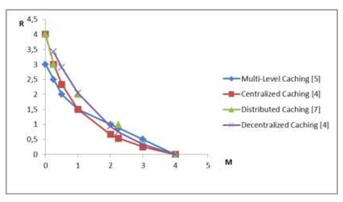
Results & Discussions

- ✓ Based on analysis of different caching schemes:

Typical caching model [5]

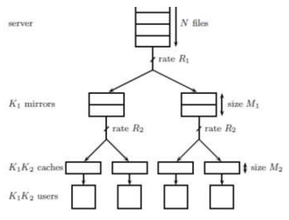
$$R(M) = K \cdot (1 - M/N)$$

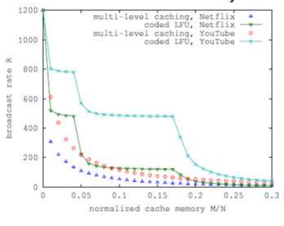




Hierarchical coded caching model [6]

$$R_D(M) \triangleq K \cdot (1 - M/N) \cdot \min\left\{\frac{N}{KM}\left(1 - (1 - M/N)^K\right), \frac{N}{K}\right\}.$$

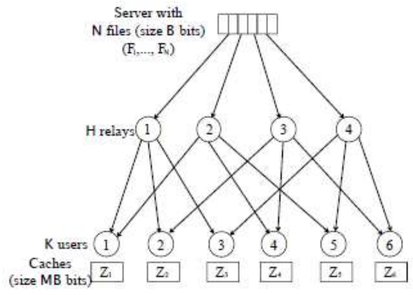


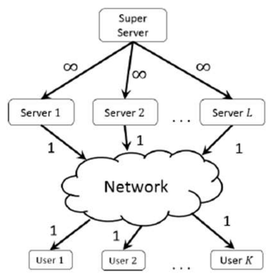


Distributed coded caching model [4][7]

$$R^{MU}(M) \approx \sum_{h \in H} KU_h + \frac{\left(\sum_{i \in I} \sqrt{N_i U_i}\right)^2}{M - \sum_{j \in J} N_j} - \sum_{i \in I} U_i,$$

- ✓ Working on Combination Networks [8] - Distributed multi level coded caching schemes:





$$g := \frac{R_r}{R} = \frac{K/H(1 - M/N)}{R} \qquad (M, R) = \left(N\frac{\binom{K''-r}{q}}{\binom{K''-r}{q} + r\binom{K'-1}{q-1}}, \frac{K/H(1 - M/N)}{g}\right)$$

Discussion:

- ✓ Is there tension between the rates in the different layers of the network?
  - If we reduce the rate in one layer, does the rate necessarily increase in other layers?
- ✓ How to extend the coding cache method to distributed multi level schemes?
  - Do we apply the single layer scheme separately at each level or jointly?

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